Converting gas-driven ventilators from oxygen to air

During our preparedness for the COVID-19 pandemic, we identified that our anaesthetic machines (GE Healthcare, Bucks, UK) had a ventilator which was gas driven, using oxygen. This resulted in a large amount of wasted oxygen. Our anaesthetic department has 52 anaesthetic machines which form part of our plan to increase our ICU capacity. To put this in context, if, for example, 500-ml tidal volumes are chosen at a respiratory rate of 12, then 6 l of oxygen per minute are wasted for each anaesthetic machine. This value is directly related to the minute ventilation set on the ventilator except for a small constant bleed/leak; that is, if the minute ventilation is halved, the oxygen wastage is halved. In our department, with all anaesthetic machines in use, this would result in 449,280 l of oxygen being wasted each day in order to drive the ventilators and is in addition to the amount of oxygen delivered to the patient.

Our vacuum insulated evaporator has a capacity of 15,690 liquid l of oxygen which provides 13,210 m^3 of oxygen in its gaseous state or 13,210,000 l. Under normal conditions this would last anything between 8 and 14 days. The hospital has a telemetry system in which British oxygen company is alerted when stores reach 40% of stock liquid level. This has recently been increased to 70% during the COVID-19 crisis.

Air, however, in our hospital, is produced from a medical grade air compressor and is piped around the hospital at 4 bar pressure. Until now, GE Healthcare routinely commissioned their anaesthetic machines with oxygen, not air, because oxygen was traditionally thought to be a more reliable gas, whereas compressed air has, at times, contained water or oil contamination.

We wish to urgently bring to the attention of other UK anaesthetists the fact that there is a simple procedure in which either a GE Healthcare engineer, or an in-house electrical and biomedical engineering department engineer, can make the switch from oxygen to air as the driving gas for the ventilators. The procedure for changing the driving gas can be found in the user manual. It requires no new additional parts and takes around 45 min to complete per machine.

In brief, the oxygen and air pipeline manifolds have a drive gas connection, this tubing can be seen passing from the manifolds to the ventilator engine, the pipeline connection not in use is plugged. Disconnect the drive gas hose and reconnect to the new gas connection. Plug the unused connection as before. Finally, there has to be a small software change. The drive gas selection on the ventilator service setup screen requires changing over from oxygen to air. It is simple to do. Lastly, an air cylinder is required on the back of the machine as a safety backup in the event of a pipeline supply failure.

The technical help call centre for GE Healthcare is 0800 387 377 or they can be emailed at uk.customerserviceoffice@med.ge.com.

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